

Claims

- [c1] 1. A transmission line assembly for transmitting information along a downhole tool, the downhole tool comprising a pin end, a box end, and a central bore traveling between the pin end and the box end, the transmission line assembly comprising:
- a protective conduit;
 - a transmission line routed through the protective conduit;
 - the protective conduit being further routed through the central bore, the ends thereof being routed through channels formed in the pin end and box end; and
 - The protective conduit being further elastically forced into a non-linear path through the central bore by elastically confining the protective conduit to a length within the central bore shorter than the protective conduit.
- [c2] 2. The transmission line assembly of claim 1, wherein the non-linear path is substantially a spiral.
- [c3] 3. The transmission line assembly of claim 1, wherein the diameter of the protective conduit is narrowed to provide improved contact between the protective conduit and the transmission line.

- [c4] 4. The transmission line assembly of claim 3, wherein the narrowed diameter of the protective conduit provides additional stiffness to the protective conduit.
- [c5] 5. The transmission line assembly of claim 4, wherein the stiffened protective conduit is less subject to deformation in the presence of at least one of downhole cement, other downhole tools, and drilling fluids.
- [c6] 6. The transmission line assembly of claim 1, wherein the protective conduit is urged against the interior surface of the central bore.
- [c7] 7. The transmission line assembly of claim 6, wherein the protective conduit is further configured to stay substantially pressed against the internal bore when the downhole tool bends.
- [c8] 8. The transmission line assembly of claim 1, wherein the transmission line is selected from the group consisting of coaxial cable, conductive wire, optical fiber, and waveguides.
- [c9] 9. The transmission line assembly of claim 1, wherein the ends of the protective conduit are fixed proximate the pin end and the box end of the downhole tool.
- [c10] 10. A method for routing a transmission line assembly

through a drill tool having a pin end, a box end, and a central bore traveling between the pin end and the box end, the method comprising:

providing a protective conduit;

routing a transmission line through the protective conduit;

routing the protective conduit through the central bore, the ends thereof being routed through channels formed in the pin end and box end; and

forcing the protective conduit to take a non-linear path through the central bore by elastically forcing the protective conduit to fit within a length of the central bore shorter than the protective conduit.

- [c11] 11. The method of claim 10, wherein the non-linear path is substantially a spiral.
- [c12] 12. The method of claim 11, further comprising narrowing the diameter of the protective conduit to provide improved contact between the protective conduit and the transmission line.
- [c13] 13. The method of claim 12, wherein narrowing the diameter provides additional stiffness to the protective conduit.
- [c14] 14. The method of claim 13, wherein the stiffened pro-

protective conduit is less subject to deformation in the presence of at least one of downhole cement, other downhole tools, and drilling fluids.

- [c15] 15. The method of claim 10, further comprising urging the protective conduit against the interior surface of the central bore.
- [c16] 16. The method of claim 10, further comprising maintaining contact between the protective conduit and the internal bore when the downhole tool bends.
- [c17] 17. The method of claim 10, further comprising selecting the transmission line from the group consisting of coaxial cable, conductive wire, optical fiber, and waveguides.
- [c18] 18. The method of claim 10, further comprising fixing the ends of the protective conduit proximate the pin end and the box end of the downhole tool, respectively.
- [c19] 19. A method for forming a transmission line assembly for routing through a drill tool having a pin end, a box end, and a central bore traveling between the pin end and the box end, the method comprising:
 - providing a protective conduit;
 - routing a transmission line through the protective conduit;
 - narrowing the diameter of the protective conduit to pro-

vide improved contact between the protective conduit and the transmission line; and routing the protective conduit through the drill tool such that it substantially spirals elastically around the interior surface of the central bore, the ends thereof being routed through channels formed in the pin end and box end.

- [c20] 20. The method of claim 19, wherein narrowing the diameter of the protective conduit provides additional stiffness to the protective conduit.